CLAIMS

1. A method of wavefront analysis comprising:

obtaining a plurality of differently phase changed transformed wavefronts corresponding to a wavefront being analyzed which has an amplitude and a phase;

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said wavefront being analyzed.

2. A method of wavefront analysis according to claim 1 and wherein said plurality of intensity maps are employed to provide an analytical output indicating said amplitude and phase.

3. A method of wavefront analysis according to claim 1 and wherein said plurality of differently phase changed transformed wavefronts are obtained by interference of said wavefront being analyzed along a common optical path.

4. A method of wavefront analysis according to claim 1 and wherein said plurality of differently phase changed transformed wavefronts are realized in a manner substantially different from performing a delta-function phase change to said wavefront following the transforming thereof.

5. A method of wavefront analysis according to claim 1 and wherein said plurality of intensity maps are employed to obtain an output indicating said phase which is substantially free from halo and shading off distortions.

6. A method according to claim 1 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts resulting from at least one of application of spatial phase changes to a transformed wavefront and transforming of a wavefront following application of spatial phase changes thereto.

7. A method according to claim 1 and wherein obtaining a plurality of differently phase changed transformed wavefronts comprises:

applying a transform to said wavefront being analyzed thereby to obtain a transformed wavefront; and

applying a plurality of different phase changes to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

8. A method according to claim 7 and wherein said plurality of different phase changes includes spatial phase changes.

9. A method according to claim 8 and wherein said plurality of different spatial phase changes are effected by applying a time-varying spatial phase change to part of said transformed wavefront.

10. A method according to claim 8 and wherein said plurality of different spatial phase changes are effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront.

11. A method according to claim 10, wherein said transform applied to said wavefront being analyzed is a Fourier transform and wherein said obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts includes applying a Fourier transform to said plurality of differently phase changed transformed wavefronts.

12. A method according to claim 10 and wherein:

said transform applied to said wavefront being analyzed is a Fourier transform;

said plurality of different spatial phase changes comprises at least three different phase changes;

said plurality of intensity maps comprises at least three intensity maps; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said wavefront being analyzed includes:

expressing said wavefront being analyzed as a first complex function which has an amplitude and phase identical to said amplitude and phase of said wavefront being analyzed;

expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

defining a second complex function, having an absolute value and a phase, as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function;

a difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes which each correspond to one of said at least three intensity maps;

solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function;

solving said second complex function to obtain said phase of said second complex function; and

obtaining said phase of said wavefront being analyzed by adding said phase of said second complex function to said difference between said phase of said wavefront being analyzed and said phase of said second complex function.

13. A method according to claim 12 and wherein said absolute value of said second complex function is obtained by approximating said absolute value to a polynomial of a given degree.

14. A method according to claim 12 and wherein said phase of said second complex function is obtained by expressing said second complex function as an

eigen-value problem where the complex function is an eigen-vector obtained by an iterative process.

15. A method according to claim 12 and wherein said phase of said second complex function is obtained by functionality including:

approximating said Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change to a polynomial; and

approximating said second complex function to a polynomial.

16. A method according to claim 12 and wherein said amplitude of said wavefront being analyzed, said absolute value of said second complex function, and said difference between said phase of said second complex function and said phase of said wavefront being analyzed are obtained by a least-square method, which has increased accuracy as the number of said plurality of intensity maps increases.

17. A method according to claim 12 and wherein:

said plurality of different phase changes comprises at least four different phase changes;

said plurality of intensity maps comprises at least four intensity maps; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said wavefront being analyzed includes:

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function;

a difference between said phase of said wavefront being analyzed and said phase of said second complex function;

a known phase delay produced by one of said at least four different phase changes which each correspond to one of said at least four intensity maps; and

at least one additional unknown relating to said wavefront analysis, where the number of said at least one additional unknown is no greater than the number by which said plurality intensity maps exceeds three; and

solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function, said difference between said phase of said wavefront being analyzed and said phase of said second complex function and said at least one additional unknown.

18. A method according to claim 12 and wherein said phase changes are chosen as to maximize contrast in said intensity maps and to minimize effects of noise on said phase of said wavefront being analyzed.

19. A method according to claim 12 and wherein:

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function;

a difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes which each correspond to one of said at least three intensity maps comprises:

defining fourth, fifth and sixth complex functions, none of which being a function of any of said plurality of intensity maps or of said time-varying spatial phase change, each of said fourth, fifth and sixth complex functions being a function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function; and

said difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

expressing each of said plurality of intensity maps as a sum of said fourth complex function, said fifth complex function multiplied by the sine of said known phase delay corresponding to each one of said plurality of intensity maps and said sixth complex function multiplied by the cosine of said known phase delay corresponding to each one of said plurality of intensity maps.

20. A method according to claim 12 and wherein solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function includes:

obtaining two solutions for each of said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function, said two solutions being a higher value solution and a lower value solution;

combining said two solutions into an enhanced absolute value solution for said absolute value of said second complex function, by choosing at each spatial location either the higher value solution or the lower value solution of said two solutions in a way that said enhanced absolute value solution satisfies said second complex function; and

combining said two solutions of said amplitude of said wavefront being analyzed into enhanced amplitude solution, by choosing at each spatial location the higher value solution or the lower value solution of said two solutions of said amplitude in said way that at each location where said higher value solution is chosen for said absolute value solution, said higher value solution is chosen for said amplitude solution and at each location where said lower value solution is chosen for said absolute value solution, said lower value solution is chosen for said amplitude solution; and

combining said two solutions of said difference between said phase of said wavefront being analyzed and said phase of said second complex function into an enhanced difference solution, by choosing at each spatial location the higher value solution or the lower value solution of said two solutions of said difference in said way that at each location where said higher value solution is chosen for said absolute value solution, said higher value solution is chosen for said difference solution and at each location where said lower value solution is chosen for said absolute value solution, said lower value solution is chosen for said difference solution.

21. A method according to claim 10 and wherein said spatially uniform, time-varying spatial phase change is applied to a spatially central part of said

transformed wavefront.

22. A method according to claim 21 and wherein said transform applied to said wavefront being analyzed is a Fourier transform and wherein said obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts includes applying a Fourier transform to said plurality of differently phase changed transformed wavefronts.

23. A method according to claim 21 and also comprising:

adding a phase component comprising relatively high frequency components to said wavefront being analyzed prior to applying said transform thereto in order to increase the high-frequency content of said transformed wavefront prior to said applying said spatially uniform, time-varying spatial phase change to part of said transformed wavefront.

24. A method according to claim 10 and wherein said spatially uniform, time-varying spatial phase change is applied to a spatially centered generally circular region of said transformed wavefront.

25. A method according to claim 10 and wherein said spatially uniform, time-varying spatial phase change is applied to approximately one half of said transformed wavefront.

26. A method according to claim 10 and wherein:

said transformed wavefront includes a DC region and a non-DC region; and

said spatially uniform, time-varying spatial phase change is applied to at least part of both said DC region and said non-DC region.

27. A method according to claim 1 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts whose phase has been changed by employing an at least time varying phase change function.

28. A method according to claim 1 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts whose phase has been changed by applying an at least time varying phase change function to said wavefront being analyzed.

29. A method according to claim 28 and wherein said at least time varying phase change function is applied to said wavefront being analyzed prior to transforming thereof.

30. A method according to claim 28 and wherein said at least time varying phase change function is applied to said wavefront being analyzed subsequent to transforming thereof.

31. A method according to claim 6 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts whose phase has been changed by employing an at least time varying phase change function.

32. A method according to claim 6 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts whose phase has been changed by applying an at least time varying phase change function to said wavefront to be analyzed.

33. A method according to claim 32 and wherein said at least time varying phase change function is applied to said wavefront to be analyzed prior to transforming thereof.

34. A method according to claim 33 and wherein said at least time varying phase change function is a spatially uniform spatial function.

35. A method according to claim 32 and wherein said at least time varying phase change function is applied to said wavefront to be analyzed subsequent to transforming thereof.

36. A method according to claim 8 and wherein:

said transformed wavefront comprises a plurality of different wavelength components; and

said plurality of different spatial phase changes are effected by applying a phase change to said plurality of different wavelength components of said transformed wavefront.

37. A method according to claim 36 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is a time-varying spatial phase change.

38. A method according to claim 36 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is effected by passing said transformed wavefront through an object, at least one of whose thickness and refractive index varies spatially.

39. A method according to claim 36 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is effected by reflecting said transformed wavefront from a spatially varying surface.

40. A method according to claim 36 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is selected to be different to a predetermined extent for at least some of said plurality of different wavelength components.

41. A method according to claim 36 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is identical for at least some of said plurality of different wavelength components.

42. A method according to claim 40 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is effected

by passing said transformed wavefront through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially.

43. A method according to claim 41 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is effected by passing said transformed wavefront through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially.

44. A method according to claim 1 and wherein:

said wavefront being analyzed comprises a plurality of different wavelength components; and

said plurality of differently phase changed transformed wavefronts are obtained by applying a phase change to said plurality of different wavelength components of said wavefront being analyzed.

45. A method according to claim 44 and wherein said phase change is applied to said plurality of different wavelength components of said wavefront being analyzed prior to transforming thereof.

46. A method according to claim 44 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through an object, at least one of whose thickness and refractive index varies spatially.

47. A method according to claim 46 and wherein:

said obtaining a plurality of intensity maps is performed simultaneously for all of said plurality of different wavelength components; and

said obtaining a plurality of intensity maps includes dividing said plurality of phase changed transformed wavefronts into separate wavelength components.

48. A method according to claim 47 and wherein said dividing said plurality of phase changed transformed wavefronts is effected by passing said plurality of phase changed transformed wavefronts through a dispersion element.

49. A method according to claim 46 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through an object, at least one of whose thickness and refractive index varies spatially, following transforming of said wavefront being analyzed.

50. A method according to claim 44 and wherein said phase change applied to said plurality of different wavelength components is effected by reflecting said wavefront being analyzed from a spatially varying surface.

51. A method according to claim 50 and wherein said phase change applied to said plurality of different wavelength components is effected by reflecting said wavefront being analyzed from a spatially varying surface, following transforming of said wavefront being analyzed.

52. A method according to claim 44 and wherein said phase change applied to said plurality of different wavelength components is selected to be different to a predetermined extent for at least some of said plurality of different wavelength components.

53. A method according to claim 44 and wherein said phase change applied to said plurality of different wavelength components is identical for at least some of said plurality of different wavelength components.

54. A method according to claim 52 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially.

55. A method according to claim 54 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially, following transforming of said wavefront being analyzed.

56. A method according to claim 53 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially.

57. A method according to claim 56 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially, following transforming of said wavefront being analyzed.

58. A method according to claim 1 and wherein:

said wavefront being analyzed comprises a plurality of different polarization components; and

said plurality of differently phase changed transformed wavefronts are obtained by applying a phase change to said plurality of different polarization components of said wavefront being analyzed prior to transforming thereof.

59. A method according to claim 8 and wherein:

said transformed wavefront comprises a plurality of different polarization components; and

said plurality of different spatial phase changes are effected by applying a phase change to said plurality of different polarization components of said transformed wavefront.

60. A method according to claim 59 and wherein said phase change applied to said

plurality of different polarization components of said transformed wavefront is different for at least some of said plurality of different polarization components.

61. A method according to claim 59 and wherein said phase change applied to said plurality of different polarization components of said transformed wavefront is identical for at least some of said plurality of different polarization components.

62. A method of wavefront analysis according to claim 7 and wherein obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts includes:

applying a transform to said plurality of differently phase changed transformed wavefronts.

63. A method according to claim 62 and wherein said plurality of phase changed transformed wavefronts are reflected from a reflecting surface so that said transform applied to said plurality of differently phase changed transformed wavefronts is identical to said transform applied to said wavefront being analyzed.

64. A method according to claim 7 and wherein said transform applied to said wavefront being analyzed is a Fourier transform.

65. A method according to claim 1 and wherein said plurality of intensity maps are obtained by reflecting said plurality of differently phase changed transformed wavefronts from a reflecting surface so as to transform said plurality of differently phase changed transformed wavefronts.

66. A method of wavefront analysis according to claim 1 and wherein obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts includes:

applying a transform to said plurality of differently phase changed transformed wavefronts.

67. A method of wavefront analysis according to claim 1 and wherein employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said wavefront being analyzed includes:

expressing said plurality of intensity maps as at least one mathematical function of phase and amplitude of said wavefront being analyzed; and

employing said at least one mathematical function to obtain an output indicating said phase and amplitude.

68. A method of wavefront analysis according to claim 7 and wherein employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said wavefront being analyzed includes:

expressing said plurality of intensity maps as at least one mathematical function of phase and amplitude of said wavefront being analyzed and of said plurality of different phase changes, wherein said phase and amplitude are unknowns and said plurality of different phase changes are known; and

employing said at least one mathematical function to obtain an output indicating said phase and amplitude.

69. A method of wavefront analysis according to claim 1 and wherein:

said plurality of intensity maps comprises at least four intensity maps; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said wavefront being analyzed includes employing a plurality of combinations, each of at least three of said plurality of intensity maps, to provide a plurality of indications of said amplitude and phase of said wavefront being analyzed.

70. A method of wavefront analysis according to claim 69 and also comprising employing said plurality of indications of said amplitude and phase of said wavefront being analyzed to provide an enhanced indication of said amplitude and phase of said wavefront being analyzed.

71. A method of wavefront analysis according to claim 69 and wherein at least some of said plurality of indications of said amplitude and phase are at least second

order indications of said amplitude and phase of said wavefront being analyzed.

72. A method according to claim 1 and wherein obtaining a plurality of differently phase changed transformed wavefronts comprises:

applying a transform to said wavefront being analyzed, thereby to obtain a transformed wavefront; and

applying a plurality of different phase and amplitude changes to said transformed wavefront, thereby to obtain a plurality of differently phase and amplitude changed transformed wavefronts.

73. A method according to claim 72 and wherein:

said plurality of different phase and amplitude changes comprises at least three different phase and intensity changes;

said plurality of different phase and amplitude changes are effected by applying at least one of a spatially uniform, time-varying spatial phase change and a spatially uniform, time-varying spatial amplitude change to at least part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said wavefront being analyzed includes:

expressing said wavefront being analyzed as a first complex function which has an amplitude and phase identical to said amplitude and phase of said wavefront being analyzed;

expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing at least one of a spatially uniform, time-varying spatial phase change and a spatially uniform, time-varying spatial amplitude change;

defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function; and

a difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

said spatial function governing at least one of a spatially uniform, time-varying spatial phase change and a spatially uniform, time-varying spatial amplitude change, comprising:

defining fourth, fifth, sixth and seventh complex functions, none of which being a function of any of said plurality of intensity maps or of said time-varying spatial phase change, each of said fourth, fifth, sixth and seventh complex functions being a function of at least one of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function; and

said difference between said phase of said wavefront being analyzed and said phase of said second complex function;

defining an eighth function of a phase delay and of an amplitude change, both produced by one of said at least three different phase and amplitude changes, corresponding to said at least three intensity maps; and

expressing each of said plurality of intensity maps as a sum of said fourth complex function, said fifth complex function multiplied by the absolute value squared of said eighth function, said sixth complex function multiplied by said eighth function and said seventh complex function multiplied by the complex conjugate of said eighth function;

solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function;

solving said second complex function to obtain said phase of said second complex function; and

obtaining said phase of said wavefront being analyzed by adding said phase of said second complex function to said difference between said phase of said wavefront being analyzed and phase of said second complex function.

74. A method according to claim 1 and wherein:

said wavefront being analyzed comprises at least two wavelength components;

said obtaining a plurality of intensity maps also includes dividing said phase changed transformed wavefronts according to said at least two wavelength components in order to obtain at least two wavelength components of said phase changed transformed wavefronts and in order to obtain at least two sets of intensity maps, each set corresponding to a different one of said at least two wavelength components of said phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said wavefront being analyzed includes obtaining an output indicative of the phase of said wavefront being analyzed from each of said at least two sets of intensity maps and combining said outputs to provide an enhanced indication of phase of said wavefront being analyzed, in which enhanced indication, there is no 2π ambiguity.

75. A method according to claim 1 and wherein said wavefront being analyzed is an acoustic radiation wavefront.

76. A method according to claim 7 and wherein:

said wavefront being analyzed comprises at least one one-dimensional component;

said transform applied to said wavefront being analyzed is a one-dimensional Fourier transform, performed in a dimension perpendicular to a direction of propagation of said wavefront being analyzed, thereby to obtain at least one one-dimensional component of said transformed wavefront in said dimension perpendicular to said direction of propagation;

said plurality of differently phase changed transformed wavefronts are obtained by applying said plurality of different phase changes to each of said at least one one-dimensional component, thereby obtaining at least one one-dimensional component of said plurality of phase changed transformed wavefronts; and

said plurality of intensity maps are employed to obtain an output indicating amplitude and phase of said at least one one-dimensional component of said wavefront being analyzed.

77. A method according to claim 76 and wherein said plurality of different phase changes is applied to each of said at least one one-dimensional component by providing a relative movement between said wavefront being analyzed and an element, which element generates spatially varying, time-constant phase changes, said relative movement being in an additional dimension which is perpendicular both to said direction of propagation and to said dimension perpendicular to said direction of propagation.

78. A method according to claim 76 and wherein:

said wavefront being analyzed comprises a plurality of different wavelength components;

said plurality of different phase changes are applied to said plurality of different wavelength components of each of said plurality of one-dimensional components of said wavefront being analyzed; and

said obtaining a plurality of intensity maps includes dividing said plurality of one-dimensional components of said plurality of phase changed transformed wavefronts into separate wavelength components.

79. A method according to claim 78 and wherein:

said dividing said plurality of one-dimensional components of said plurality of phase changed transformed wavefronts into separate wavelength components is achieved by passing said plurality of phase changed transformed wavefronts through a dispersion element.

80. A method according to claim 76 and wherein said transform applied to said wavefront being analyzed includes an additional Fourier transform to minimize cross-talk between different one-dimensional components of said wavefront being analyzed.

81. A method of surface mapping comprising:

obtaining a surface mapping wavefront having an amplitude and a phase, by reflecting radiation from a surface; and

analyzing said surface mapping wavefront by:

obtaining a plurality of differently phase changed transformed wavefronts corresponding to said surface mapping wavefront;

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said surface mapping wavefront.

82. A method according to claim 81 and wherein said radiation reflected from said surface has a narrow band about a given wavelength, causing said phase of said surface mapping wavefront to be proportional to geometrical variations in said surface, said proportion being an inverse linear function of said wavelength.

83. A method according to claim 81 and wherein said radiation reflected from said surface has at least two narrow bands, each centered about a different wavelength, providing at least two wavelength components in said surface mapping wavefront and at least two indications of said phase of said surface mapping wavefront, thereby enabling an enhanced mapping of said surface to be obtained by avoiding an ambiguity in the mapping which exceeds the larger of said different wavelengths about which said two narrow bands are centered.

84. A method according to claim 81 and wherein obtaining a plurality of differently phase changed transformed wavefronts comprises:

applying a transform to said surface mapping wavefront, thereby to obtain a transformed wavefront; and

applying a plurality of different phase changes, including spatial phase changes, to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

85. A method according to claim 84 and wherein:

said transform applied to said surface mapping wavefront is a Fourier transform;

said plurality of different phase changes comprises at least three different phase changes, effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said surface mapping wavefront includes:

expressing said surface mapping wavefront as a first complex function which has an amplitude and phase identical to said amplitude and phase of said surface mapping wavefront;

expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said surface mapping wavefront;

said absolute value of said second complex function;

a difference between said phase of said surface mapping wavefront and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

solving said third function to obtain said amplitude of said surface mapping wavefront, said absolute value of said second complex function and said difference between said phase of said surface mapping wavefront and said phase of said second complex function;

solving said second complex function to obtain said phase of said second complex function; and

obtaining said phase of said surface mapping wavefront by adding said phase of said second complex function to said difference between said phase of said surface mapping wavefront and phase of said second complex function.

86. A method according to claim 81 and wherein:

said surface mapping wavefront comprises a plurality of different wavelength components; and

said plurality of differently phase changed transformed wavefronts are obtained by:

transforming said surface mapping wavefront thereby obtaining a transformed wavefront comprising a plurality of different wavelength components; and

applying a phase change to said plurality of different wavelength components of said transformed wavefront by passing said transformed wavefront through an object, at least one of whose thickness and refractive index varies spatially.

87. A method of inspecting an object comprising:

obtaining an object inspection wavefront which has an amplitude and a phase, by transmitting radiation through said object; and

analyzing said object inspection wavefront by:

obtaining a plurality of differently phase changed transformed wavefronts corresponding to said object inspection wavefront;

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said object inspection wavefront.

88. A method according to claim 87 and wherein when said object is substantially uniform in material and other optical properties, said phase of said object inspection wavefront is proportional to said object thickness.

89. A method according to claim 87 and wherein when said object is substantially uniform in thickness, said phase of said object inspection wavefront is proportional to optical properties of said object.

90. A method according to claim 87 and wherein said radiation has at least two narrow bands, each centered about a different wavelength, providing at least two wavelength components in said object inspection wavefront and at least two indications of said phase of said object inspection wavefront, thereby enabling an enhanced mapping of thickness of said object to be inspected by avoiding an ambiguity in the mapping which exceeds the larger of said different wavelengths about which said two narrow bands are centered.

91. A method according to claim 87 and wherein obtaining a plurality of differently phase changed transformed wavefronts comprises:

applying a transform to said object inspection wavefront, thereby to obtain a transformed wavefront; and

applying a plurality of different phase changes, including spatial phase changes, to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

92. A method according to claim 91 and wherein:

said transform applied to said object inspection wavefront is a Fourier transform;

said plurality of different phase changes comprises at least three different phase changes, effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said object inspection wavefront includes:

expressing said object inspection wavefront as a first complex function which has an amplitude and phase identical to said amplitude and phase of said object inspection wavefront;

expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially. uniform, time-varying spatial phase change;

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said object inspection wavefront;

said absolute value of said second complex function;

a difference between said phase of said object inspection wavefront and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

solving said third function to obtain said amplitude of said object inspection wavefront, said absolute value of said second complex function and said difference between said phase of said object inspection wavefront and said phase of said second complex function;

solving said second complex function to obtain said phase of said second complex function; and

obtaining said phase of said object inspection wavefront by adding said phase of said second complex function to said difference between said phase of said object inspection wavefront and phase of said second complex function.

93. A method according to claim 87 and wherein:

said object inspection wavefront comprises a plurality of different wavelength components; and

said plurality of differently phase changed transformed wavefronts are obtained by:

transforming said object inspection wavefront thereby obtaining a transformed wavefront comprising a plurality of different wavelength components; and

applying a phase change to said plurality of different wavelength components of said transformed wavefront by reflecting said transformed wavefront

from a spatially varying surface.

94. A method of spectral analysis comprising:

obtaining a spectral analysis wavefront having an amplitude and a phase, by causing radiation to impinge on an object;

analyzing said spectral analysis wavefront by:

obtaining a plurality of differently phase changed transformed wavefronts corresponding to said spectral analysis wavefront which has an amplitude and a phase;

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said spectral analysis wavefront; and

employing said output indicating said amplitude and phase to obtain an output indicating spectral content of said radiation.

95. A method according to claim 94 and wherein obtaining said spectral analysis wavefront is effected by reflecting said radiation from said object.

96. A method according to claim 94 and wherein obtaining said spectral analysis wavefront is effected by transmitting said radiation through said object.

97. A method according to claim 94 and wherein when said radiation is substantially of a single wavelength, said phase of said spectral analysis wavefront is inversely proportional to said single wavelength, and is related to at least one of a surface characteristic and thickness of said impinged object.

98. A method according to claim 94 and wherein employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said spectral analysis wavefront includes:

expressing said plurality of intensity maps as at least one mathematical function of phase and amplitude of said spectral analysis wavefront and of said plurality of different phase changes, wherein at least said phase is unknown and a function

generating said plurality of phase changed transformed wavefronts is known; and

employing said at least one mathematical function to obtain an output indicating at least said phase.

99. A method according to claim 94 and wherein obtaining a plurality of differently phase changed transformed wavefronts comprises:

applying a transform to said spectral analysis wavefront, thereby to obtain a transformed wavefront; and

applying a plurality of different phase changes, including spatial phase changes, to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

100. A method according to claim 99 and wherein:

said transform applied to said spectral analysis wavefront is a Fourier transform;

said plurality of different phase changes comprises at least three different phase changes, effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said spectral analysis wavefront includes:

expressing said spectral analysis wavefront as a first complex function which has an amplitude and phase identical to said amplitude and phase of said spectral analysis wavefront;

expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said spectral analysis wavefront;

said absolute value of said second complex function;

a difference between said phase of said spectral analysis wavefront and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

solving said third function to obtain said amplitude of said spectral analysis wavefront, said absolute value of said second complex function and said difference between said phase of said spectral analysis wavefront and said phase of said second complex function;

solving said second complex function to obtain said phase of said second complex function; and

obtaining said phase of said spectral analysis wavefront by adding said phase of said second complex function to said difference between said phase of said spectral analysis wavefront and phase of said second complex function.

101. A method according to claim 94 and wherein:

said spectral analysis wavefront comprises a plurality of different wavelength components; and

said plurality of differently phase changed transformed wavefronts are obtained by applying a phase change to said plurality of different wavelength components of said spectral analysis wavefront.

102. A method of phase change analysis comprising:

obtaining a phase change analysis wavefront which has an amplitude and a phase;

applying a transform to said phase change analysis wavefront thereby to obtain a transformed wavefront;

applying a plurality of different phase changes to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indication of

differences between said plurality of different phase changes applied to said transformed phase change analysis wavefront.

103. A method according to claim 102 and wherein when lateral shifts appear in said plurality of different phase changes, corresponding changes appear in said plurality of intensity maps, said employing results in obtaining an indication of said lateral shifts.

104. A method according to claim 102 and wherein employing said plurality of intensity maps to obtain an output indication of differences between said plurality of different phase changes applied to said transformed phase change analysis wavefront includes:

expressing said plurality of intensity maps as at least one mathematical function of phase and amplitude of said phase change analysis wavefront and of said plurality of different phase changes, where at least said phase and amplitude are known and said plurality of different phase changes are unknown; and

employing said at least one mathematical function to obtain an output indicating said differences between said plurality of different phase changes.

105. A method of phase change analysis comprising:

obtaining a phase change analysis wavefront which has an amplitude and a phase;

applying a transform to said phase change analysis wavefront thereby to obtain a transformed wavefront;

applying at least one phase change to said transformed wavefront, thereby to obtain at least one phase changed transformed wavefront.

obtaining at least one intensity map of said at least one phase changed transformed wavefront; and

employing said at least one intensity map to obtain an output indication of said at least one phase change applied to said transformed phase change analysis wavefront.

106. A method according to claim 105 and wherein said at least one phase change is a phase delay, having a value selected from a plurality of pre-determined values, and

said output indication of said at least one phase change includes said value of said phase delay.

107. A method of stored data retrieval comprising:

obtaining a stored data retrieval wavefront which has an amplitude and a phase, by reflecting radiation from media in which information is encoded by selecting the height of the media at each of a multiplicity of different locations on the media;

analyzing said stored data retrieval wavefront by:

obtaining a plurality of differently phase changed transformed wavefronts corresponding to said stored data retrieval wavefront;

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an indication of said amplitude and phase of said stored data retrieval wavefront; and

employing said indication of said amplitude and phase to obtain said information.

108. A method according to claim 107 and wherein said obtaining a plurality of differently phase changed transformed wavefronts comprises:

applying a transform to said stored data retrieval wavefront thereby to obtain a transformed wavefront; and

applying a plurality of different phase changes to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

109. A method according to claim 108 and wherein:

said transform applied to said stored data retrieval wavefront is a Fourier transform;

said plurality of different phase changes comprises at least three different phase changes, effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said stored data retrieval wavefront includes:

expressing said stored data retrieval wavefront as a first complex function which has an amplitude and phase identical to said amplitude and phase of said stored data retrieval wavefront;

expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said stored data retrieval wavefront;

said absolute value of said second complex function;

a difference between said phase of said stored data retrieval wavefront and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

solving said third function to obtain said amplitude of said stored data retrieval wavefront, said absolute value of said second complex function and said difference between said phase of said stored data retrieval wavefront and said phase of said second complex function;

solving said second complex function to obtain said phase of said second complex function; and

obtaining said phase of said stored data retrieval wavefront by adding said phase of said second complex function to said difference between said phase of said stored data retrieval wavefront and phase of said second complex function.

110. A method according to claim 108 and wherein:

said stored data retrieval wavefront comprises at least one one-dimensional component;

said transform applied to said data retrieval wavefront is a one-dimensional Fourier transform, performed in a dimension perpendicular to a direction of propagation of said data retrieval wavefront, thereby to obtain at least one one-dimensional component of said transformed wavefront in said dimension perpendicular to said direction of propagation;

said plurality of differently phase changed transformed wavefronts are obtained by applying said plurality of different phase changes to each of said at least one one-dimensional component, thereby obtaining at least one one-dimensional component of said plurality of phase changed transformed wavefronts; and

said plurality of intensity maps are employed to obtain an output indicating amplitude and phase of said at least one one-dimensional component of said data retrieval wavefront.

111. A method according to claim 110 and wherein said plurality of different phase changes is applied to each of said at least one one-dimensional component by providing a relative movement between said media and a component generating spatially varying, time-constant phase changes, said relative movement being in a dimension perpendicular to said direction of propagation and to said dimension perpendicular to said direction of propagation.

112. A method according to claim 107 and wherein said information is encoded on said media whereby:

an intensity value is realized by reflection of light from each location on said media to lie within a predetermined range of values, said range corresponding an element of said information stored at said location; and

by employing said plurality of intensity maps, multiple intensity values are realized for each location, providing multiple elements of information for each location on said media.

113. A method according to claim 112 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts whose phase

has been changed by applying an at least time varying phase change function to said stored data retrieval wavefront.

114. A method according to claim 112 and wherein:

said stored data retrieval wavefront comprises a plurality of different wavelength components; and

said plurality of differently phase changed transformed wavefronts are obtained by applying at least one phase change to said plurality of different wavelength components of said stored data retrieval wavefront.

115. A method according to claim 107 and wherein:

said radiation which is reflected from said media comprises a plurality of different wavelength components, resulting in said stored data retrieval wavefront comprising a plurality of different wavelength components; and

said plurality of differently phase changed transformed wavefronts are obtained by applying a phase change to said plurality of different wavelength components of said stored data retrieval wavefront.

116. A method according to claim 107 and wherein:

said information encoded by selecting the height of the media at each of a multiplicity of different locations on the media is also encoded by selecting the reflectivity of the media at each of a plurality of different locations on the media; and

employing said indication of said amplitude and phase to obtain said information includes employing said indication of said phase to obtain said information encoded by selecting the height of the media and employing said indication of said amplitude to obtain said information encoded by selecting the reflectivity of the media.

117. A method of 3-dimensional imaging comprising:

obtaining a 3-dimensional imaging wavefront, which has an amplitude and a phase, by reflecting radiation from an object to be viewed; and

analyzing said 3-dimensional imaging wavefront by:

obtaining a plurality of differently phase changed transformed wavefronts

corresponding to said 3-dimensional imaging wavefront;

obtaining a plurality of intensity maps of said plurality of differently phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating said amplitude and phase of said 3-dimensional imaging wavefront.

118. A method according to claim 117 and wherein said radiation reflected from said object has a narrow band about a given wavelength, causing said phase of said 3-dimensional imaging wavefront to be proportional to geometrical variations in said object, said proportion being an inverse linear function of said wavelength.

119. A method according to claim 117 and wherein obtaining a plurality of differently phase changed transformed wavefronts comprises:

applying a transform to said 3-dimensional imaging wavefront, thereby to obtain a transformed wavefront; and

applying a plurality of different phase changes, including spatial phase changes, to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

120. A method according to claim 117 and wherein:

said 3-dimensional imaging wavefront comprises a plurality of different wavelength components; and

said plurality of differently phase changed transformed wavefronts are obtained by:

transforming said 3-dimensional imaging wavefront, thereby obtaining a transformed wavefront comprising a plurality of different wavelength components; and

applying phase changes to said plurality of different wavelength components of said transformed wavefront by passing said transformed wavefront through an object, at least one of whose thickness and refractive index varies spatially.

121. A method of wavefront analysis comprising:

obtaining a plurality of differently phase changed transformed wavefronts

corresponding to a wavefront being analyzed;

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating at least phase of said wavefront being analyzed by combining said plurality of intensity maps into a second plurality of combined intensity maps, said second plurality being less than said first plurality, obtaining at least an output indicative of said phase of said wavefront being analyzed from each of said second plurality of combined intensity maps and combining said outputs to provide at least an enhanced indication of phase of said wavefront being analyzed.

122. A method of wavefront analysis comprising:

obtaining a plurality of differently phase changed transformed wavefronts corresponding to a wavefront being analyzed;

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating at least amplitude of said wavefront being analyzed by combining said plurality of intensity maps into a second plurality of combined intensity maps, said second plurality being less than said first plurality, obtaining at least an output indicative of said amplitude of said wavefront being analyzed from each of said second plurality of combined intensity maps and combining said outputs to provide at least an enhanced indication of amplitude of said wavefront being analyzed.

123. A method of wavefront analysis comprising:

obtaining a plurality of differently phase changed transformed wavefronts corresponding to a wavefront being analyzed;

obtaining a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

employing said plurality of intensity maps to obtain an output indicating at least phase of said wavefront being analyzed by:

expressing said plurality of intensity maps as a function of:

amplitude of said wavefront being analyzed;

phase of said wavefront being analyzed; and

a phase change function characterizing said plurality of differently phase changed transformed wavefronts;

defining a complex function of:

said amplitude of said wavefront being analyzed;

said phase of said wavefront being analyzed; and

said phase change function characterizing said plurality of differently phase changed transformed wavefronts,

said complex function being characterized in that intensity at each location in said plurality of intensity maps is a function predominantly of a value of said complex function at said location and of said amplitude and said phase of said wavefront being analyzed at said location;

expressing said complex function as a function of said plurality of intensity maps; and

obtaining values for said phase by employing said complex function expressed as a function of said plurality of intensity maps.

124. A method of wavefront analysis comprising:

applying a Fourier transform to a wavefront being analyzed which has an amplitude and a phase thereby to obtain a transformed wavefront;

applying a spatially uniform time-varying spatial phase change to part of said transformed wavefront, thereby to obtain at least three differently phase changed transformed wavefronts;

applying a second Fourier transform to obtain at least three intensity maps of said at least three phase changed transformed wavefronts; and

employing said at least three intensity maps to obtain an output indicating at least one of said phase and said amplitude of said wavefront being analyzed by:

expressing said wavefront being analyzed as a first complex function which has an amplitude and phase identical to said amplitude and phase of said wavefront being analyzed;

expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function;

a difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function;

solving said second complex function to obtain said phase of said second complex function; and

obtaining said phase of said wavefront being analyzed by adding said phase of said second complex function to said difference between said phase of said wavefront being analyzed and phase of said second complex function.

125. Apparatus for wavefront analysis comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to a wavefront being analyzed which has an amplitude and a phase;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indicating said amplitude and phase of said wavefront being analyzed.

126. Apparatus for wavefront analysis according to claim 125 and wherein said intensity map utilizer employs said plurality of intensity maps to provide an analytical output indicating said amplitude and phase.

127. Apparatus for wavefront analysis according to claim 125 and wherein said wavefront transformer provides said plurality of differently phase changed transformed wavefronts by interference of said wavefront being analyzed along a common optical path.

128. Apparatus for wavefront analysis according to claim 125 and wherein said plurality of differently phase changed transformed wavefronts are realized in a manner substantially different from performing a delta-function phase change to said wavefront following transforming thereof.

129. Apparatus for wavefront analysis according to claim 125 and wherein said intensity map utilizer employs said plurality of intensity maps to provide an output indicating said phase which is substantially free from halo and shading off distortions.

130. Apparatus according to claim 125 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts resulting from at least one of application of spatial phase changes to a transformed wavefront and transforming of a wavefront following application of spatial phase changes thereto.

131. Apparatus according to claim 125 and wherein said wavefront transformer comprises:

a transform applier, applying a transform to said wavefront being analyzed thereby to obtain a transformed wavefront; and

a phase change applier, applying a plurality of different phase changes to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

132. Apparatus according to claim 131 and wherein said plurality of different phase

changes includes spatial phase changes.

133. Apparatus according to claim 132 and wherein said plurality of different spatial phase changes are effected by applying a time-varying spatial phase change to part of said transformed wavefront.

134. Apparatus according to claim 132 and wherein said plurality of different spatial phase changes are effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront.

135. Apparatus according to claim 134, wherein said transform applied to said wavefront being analyzed is a Fourier transform and wherein said intensity map generator includes a Fourier transform applier which applies a Fourier transform to said plurality of differently phase changed transformed wavefronts.

136. Apparatus according to claim 134 and wherein:

said transform applied to said wavefront being analyzed is a Fourier transform;

said plurality of different spatial phase changes comprises at least three different phase changes;

said plurality of intensity maps comprises at least three intensity maps; and

said intensity map utilizer includes:

a wavefront expresser, expressing said wavefront being analyzed as a first complex function which has an amplitude and phase identical to said amplitude and phase of said wavefront being analyzed;

a first intensity map expresser, expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

a complex function definer, defining a second complex function, having an absolute value and a phase, as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

a second intensity map expresser, expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function;

a difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes which each correspond to one of said at least three intensity maps;

a first function solver, solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function;

a second function solver, solving said second complex function to obtain said phase of said second complex function; and

a phase obtainer, obtaining said phase of said wavefront being analyzed by adding said phase of said second complex function to said difference between said phase of said wavefront being analyzed and said phase of said second complex function.

137. Apparatus according to claim 136 and wherein said first function solver is operative to obtain said absolute value of said second complex function by approximating said absolute value to a polynomial of a given degree.

138. Apparatus according to claim 136 and wherein said phase obtainer is operative to obtain the phase of said second complex function by expressing said second complex function as an eigen-value problem where the complex function is an eigen-vector obtained by an iterative process.

139. Apparatus according to claim 136 and wherein said second function solver is operative to obtain the phase of said second complex function by employing functionality including:

first approximation functionality approximating said Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change to a polynomial; and

second approximation functionality approximating said second complex function to a polynomial.

140. Apparatus according to claim 136 and wherein said first function solver is operative to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function, and said difference between said phase of said second complex function and said phase of said wavefront being analyzed by a least-square method, which has increased accuracy as the number of said plurality of intensity maps increases.

141. Apparatus according to claim 136 and wherein:

said plurality of different phase changes comprises at least four different phase changes;

said plurality of intensity maps comprises at least four intensity maps; and

said intensity map utilizer includes:

intensity map expressing functionality, expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function;

a difference between said phase of said wavefront being analyzed and said phase of said second complex function;

a known phase delay produced by one of said at least four different phase changes which each correspond to one of said at least four intensity maps; and

at least one additional unknown relating to said wavefront analysis, where the number of said at least one additional unknown is no greater than the number by which said plurality intensity maps exceeds three; and

a function solver, solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function, said

difference between said phase of said wavefront being analyzed and said phase of said second complex function and said at least one additional unknown.

142. Apparatus according to claim 136 and wherein said phase changes are chosen as to maximize contrast in said intensity maps and to minimize effects of noise on said phase of said wavefront being analyzed.

143. Apparatus according to claim 136 and wherein:

said second intensity map expresser is operative to express each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function;

a difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes which each correspond to one of said at least three intensity maps comprises:

a second complex function definer, defining fourth, fifth and sixth complex functions, none of which being a function of any of said plurality of intensity maps or of said time-varying spatial phase change, each of said fourth, fifth and sixth complex functions being a function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function; and

said difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

a third intensity map expresser, expressing each of said plurality of intensity maps as a sum of said fourth complex function, said fifth complex function multiplied by the sine of said known phase delay corresponding to each one of said plurality of intensity maps and said sixth complex function multiplied by the cosine of said known phase delay corresponding to each one of said plurality of intensity maps.

144. Apparatus according to claim 135 and wherein said first function solver includes:

function solving functionality, obtaining two solutions for each of said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function, said two solutions being a higher value solution and a lower value solution;

first combining functionality,combining said two solutions into an enhanced absolute value solution for said absolute value of said second complex function, by choosing at each spatial location either the higher value solution or the lower value solution of said two solutions in a way that said enhanced absolute value solution satisfies said second complex function; and

second combining functionality, combining said two solutions of said amplitude of said wavefront being analyzed into enhanced amplitude solution, by choosing at each spatial location the higher value solution or the lower value solution of said two solutions of said amplitude in said way that at each location where said higher value solution is chosen for said absolute value solution, said higher value solution is chosen for said amplitude solution and at each location where said lower value solution is chosen for said absolute value solution, said lower value solution is chosen for said amplitude solution; and

third combining functionality, combining said two solutions of said difference between said phase of said wavefront being analyzed and said phase of said second complex function into an enhanced difference solution, by choosing at each spatial location the higher value solution or the lower value solution of said two solutions of said difference in said way that at each location where said higher value solution is chosen for said absolute value solution, said higher value solution is chosen for said difference solution and at each location where said lower value solution is chosen for said absolute value solution, said lower value solution is chosen for said difference solution.

145. Apparatus according to claim 134 and wherein said spatially uniform, time-varying spatial phase change is applied to a spatially central part of said

transformed wavefront.

146. Apparatus according to claim 145, wherein said transform applied to said wavefront being analyzed is a Fourier transform and wherein said intensity map generator includes a Fourier transform applier which applies a Fourier transform to said plurality of differently phase changed transformed wavefronts.

147. Apparatus according to claim 145, and also comprising:

a phase adder operative to add a phase component comprising relatively high frequency components to said wavefront being analyzed prior to applying said transform thereto in order to increase the high-frequency content of said transformed wavefront prior to said applying said spatially uniform, time-varying spatial phase change to part of said transformed wavefront.

148. Apparatus according to claim 134 and wherein said spatially uniform, time-varying spatial phase change is applied to a spatially centered generally circular region of said transformed wavefront.

149. Apparatus according to claim 134 and wherein said spatially uniform, time-varying spatial phase change is applied to approximately one half of said transformed wavefront.

150. Apparatus according to claim 134 and wherein:

said transformed wavefront includes a DC region and a non-DC region; and

said spatially uniform, time-varying spatial phase change is applied to at least part of both said DC region and said non-DC region.

151. Apparatus according to claim 125 and wherein said wavefront transformer comprises a phase changer operative to change the phase of a plurality of wavefronts by employing an at least time varying phase change function.

152. Apparatus according to claim 125 and wherein said plurality of differently

phase changed transformed wavefronts comprise a plurality of wavefronts whose phase has been changed by a phase changer, operative to apply an at least time varying phase change function to said wavefront being analyzed.

153. Apparatus according to claim 152 and wherein said phase changer is operative to provide an at least time varying phase change function to said wavefront being analyzed prior to transforming thereof.

154. Apparatus according to claim 152 and wherein said phase changer is operative to provide an at least time varying phase change function to said wavefront being analyzed subsequent to transforming thereof.

155. Apparatus according to claim 130 and wherein said wavefront transformer comprises a phase changer operative to change the phase of a plurality of wavefronts by employing an at least time varying phase change function.

156. Apparatus according to claim 130 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts whose phase has been changed by a phase changer, operative to apply an at least time varying phase change function to said wavefront to be analyzed.

157. Apparatus according to claim 156 and wherein said phase changer is operative to provide an at least time varying phase change function to said wavefront to be analyzed prior to transforming thereof.

158. Apparatus according to claim 157, and wherein said at least time varying phase change function is a spatially uniform spatial function.

159. Apparatus according to claim 156 and wherein said phase changer is operative to provide an at least time varying phase change function to said wavefront to be analyzed subsequent to transforming thereof.

160. Apparatus according to claim 132 and wherein:

said transformed wavefront comprises a plurality of different wavelength components; and

said plurality of different spatial phase changes are effected by applying a phase change to said plurality of different wavelength components of said transformed wavefront.

161. Apparatus according to claim 160, and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is a time-varying spatial phase change.

162. Apparatus according to claim 160 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is effected by passing said transformed wavefront through an object, at least one of whose thickness and refractive index varies spatially.

163. Apparatus according to claim 160 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is effected by reflecting said transformed wavefront from a spatially varying surface.

164. Apparatus according to claim 160 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is selected to be different to a predetermined extent for at least some of said plurality of different wavelength components.

165. Apparatus according to claim 160 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is identical for at least some of said plurality of different wavelength components.

166. Apparatus according to claim 164 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is effected by passing said transformed wavefront through a plurality of objects, each

characterized in that at least one of its thickness and refractive index varies spatially.

167. Apparatus according to claim 165 and wherein said phase change applied to said plurality of different wavelength components of said transformed wavefront is effected by passing said transformed wavefront through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially.

168. Apparatus according to claim 125 and wherein:

said wavefront being analyzed comprises a plurality of different wavelength components; and

said wavefront transformer is operative to apply a phase change to said plurality of different wavelength components of said wavefront being analyzed, thereby obtaining said plurality of differently phase changed transformed wavefronts.

169. Apparatus according to claim 168 and wherein said wavefront transformer is operative to apply said phase change to said plurality of different wavelength components of said wavefront being analyzed prior to transforming thereof.

170. Apparatus according to claim 168 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through an object, at least one of whose thickness and refractive index varies spatially.

171. Apparatus according to claim 170, and wherein:

said intensity map generator is operative to obtain said plurality of intensity maps simultaneously for all of said plurality of different wavelength components; and

said intensity map generator includes a wavelength divider, dividing said plurality of phase changed transformed wavefronts into separate wavelength components.

172. Apparatus according to claim 171 and wherein said wavelength divider includes a dispersion element, dividing said plurality of phase changed transformed wavefronts passing therethrough into separate wavelength components.

173. Apparatus according to claim 170 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through an object, at least one of whose thickness and refractive index varies spatially, following transforming of said wavefront being analyzed.

174. Apparatus according to claim 168 and wherein said phase change applied to said plurality of different wavelength components is effected by reflecting said wavefront being analyzed from a spatially varying surface.

175. Apparatus according to claim 174 and wherein said phase change applied to said plurality of different wavelength components is effected by reflecting said wavefront being analyzed from a spatially varying surface, following transforming of said wavefront being analyzed.

176. Apparatus according to claim 168 and wherein said phase change applied to said plurality of different wavelength components is selected to be different to a predetermined extent for at least some of said plurality of different wavelength components.

177. Apparatus according to claim 168 and wherein said phase change applied to said plurality of different wavelength components is identical for at least some of said plurality of different wavelength components.

178. Apparatus according to claim 176 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially.

179. Apparatus according to claim 178 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially, following transforming of said wavefront being analyzed.

180. Apparatus according to claim 177 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially.

181. Apparatus according to claim 180 and wherein said phase change applied to said plurality of different wavelength components is effected by passing said wavefront being analyzed through a plurality of objects, each characterized in that at least one of its thickness and refractive index varies spatially, following transforming of said wavefront being analyzed.

182. Apparatus according to claim 125, and wherein:

said wavefront being analyzed comprises a plurality of different polarization components; and

said wavefront transformer is operative to apply a phase change to said plurality of different polarization components of said wavefront being analyzed prior to transforming thereof, thereby obtaining said plurality of differently phase changed transformed wavefronts.

183. Apparatus according to claim 132 and wherein:

said transformed wavefront comprises a plurality of different polarization components; and

said plurality of different spatial phase changes are effected by applying a phase change to said plurality of different polarization components of said transformed wavefront.

184. Apparatus according to claim 183 and wherein said phase change applied to said plurality of different polarization components of said transformed wavefront is different for at least some of said plurality of different polarization components.

185. Apparatus according to claim 183 and wherein said phase change applied to said plurality of different polarization components of said transformed wavefront is identical for at least some of said plurality of different polarization components.

186. Apparatus for wavefront analysis according to claim 131 and wherein said intensity map generator includes:

a second transform applier, applying a transform to said plurality of differently phase changed transformed wavefronts.

187. Apparatus according to claim 186 and wherein said plurality of phase changed transformed wavefronts are reflected from a reflecting surface so that said transform applier, applying a transform to said wavefront being analyzed and said second transform applier, applying a transform to said plurality of differently phase changed transformed wavefronts, are the same element.

188. Apparatus according to claim 131 and wherein said transform applier applies a Fourier transform to said wavefront being analyzed.

189. Apparatus according to claim 125 and wherein said intensity map generator includes a reflecting surface, reflecting said plurality of differently phase changed transformed wavefronts so as to transform said plurality of differently phase changed transformed wavefronts.

190. Apparatus for wavefront analysis according to claim 125 and wherein said intensity map generator includes a transform applier, applying a transform to said plurality of differently phase changed transformed wavefronts.

191. Apparatus for wavefront analysis according to claim 125 and wherein said

intensity map utilizer includes:

an intensity map expresser, expressing said plurality of intensity maps as at least one mathematical function of phase and amplitude of said wavefront being analyzed; and

a function solver, employing said at least one mathematical function to obtain an output indicating said phase and amplitude.

192. Apparatus for wavefront analysis according to claim 131 and wherein said intensity map utilizer includes:

an intensity map expresser, expressing said plurality of intensity maps as at least one mathematical function of phase and amplitude of said wavefront being analyzed and of said plurality of different phase changes, wherein said phase and amplitude are unknowns and said plurality of different phase changes are known; and

a function solver, employing said at least one mathematical function to obtain an output indicating said phase and amplitude.

193. Apparatus for wavefront analysis according to claim 125 and wherein:

said plurality of intensity maps comprises at least four intensity maps; and

said intensity map utilizer includes an indication provider, employing a plurality of combinations, each of at least three of said plurality of intensity maps, to provide a plurality of indications of said amplitude and phase of said wavefront being analyzed.

194. Apparatus for wavefront analysis according to claim 193 and wherein said indication provider also includes an enhanced indication provider, employing said plurality of indications of said amplitude and phase of said wavefront being analyzed to provide an enhanced indication of said amplitude and phase of said wavefront being analyzed.

195. Apparatus for wavefront analysis according to claim 193 and wherein at least some of said plurality of indications of said amplitude and phase are at least second order indications of said amplitude and phase of said wavefront being analyzed.

196. Apparatus according to claim 125 and wherein said wavefront transformer comprises:

a transform applier, applying a transform to said wavefront being analyzed, thereby to obtain a transformed wavefront; and

a phase and intensity change applier, applying a plurality of different phase and intensity changes to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

197. Apparatus according to claim 196 and wherein:

said plurality of different phase and intensity changes comprises at least three different phase and intensity changes;

said phase and intensity change applier is operative by applying at least one of a spatially uniform, time-varying spatial phase change and a spatially uniform, time-varying spatial intensity change to at least part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

said intensity map utilizer includes:

a wavefront expresser, expressing said wavefront being analyzed as a first complex function which has an amplitude and phase identical to said amplitude and phase of said wavefront being analyzed;

a first intensity map expresser, expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing at least one of a spatially uniform, time-varying spatial phase change and a spatially uniform, time-varying spatial intensity change;

a complex function definer, defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

a second intensity map expresser, expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function; and

a difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

said spatial function governing at least one of a spatially uniform, time-varying spatial phase change and a spatially uniform, time-varying spatial intensity change, comprising:

a second complex function definer, defining fourth, fifth, sixth and seventh complex functions, none of which being a function of any of said plurality of intensity maps or of said time-varying spatial phase change, each of said fourth, fifth, sixth and seventh complex functions being a function of at least one of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function; and

said difference between said phase of said wavefront being analyzed and said phase of said second complex function;

a third function definer, defining an eighth function of a phase delay and of an intensity change, both produced by one of said at least three different phase and intensity changes, corresponding to said at least three intensity maps; and

a third intensity map expresser, expressing each of said plurality of intensity maps as a sum of said fourth complex function, said fifth complex function multiplied by the absolute value squared of said eighth function, said sixth complex function multiplied by said eighth function and said seventh complex function multiplied by the complex conjugate of said eighth function;

a first function solver, solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function;

a second function solver, solving said second complex function to obtain said phase of said second complex function; and

a phase obtainer, obtaining said phase of said wavefront being analyzed by adding said phase of said second complex function to said difference between said phase of said wavefront being analyzed and said phase of said second complex function.

198. Apparatus according to claim 125, and wherein:

said wavefront being analyzed comprises at least two wavelength components;

said intensity map generator also includes a wavefront divider, dividing said phase changed transformed wavefronts according to said at least two wavelength components thereby obtaining at least two wavelength components of said phase changed transformed wavefronts and subsequently obtaining at least two sets of intensity maps, each set corresponding to a different one of said at least two wavelength components of said phase changed transformed wavefronts; and

said intensity map utilizer includes a phase obtainer, obtaining an output indicative of the phase of said wavefront being analyzed from each of said at least two sets of intensity maps and combining said outputs to provide an enhanced indication of phase of said wavefront being analyzed, in which enhanced indication, there is no 2π ambiguity.

199. Apparatus according to claim 125, and wherein said wavefront being analyzed is an acoustic radiation wavefront.

200. Apparatus according to claim 131 and wherein:

said wavefront being analyzed comprises at least one one-dimensional component;

said transform applier is operative to perform a one-dimensional Fourier transform to said wavefront being analyzed is, performed in a dimension perpendicular to a direction of propagation of said wavefront being analyzed, thereby to obtain at least one one-dimensional component of said transformed wavefront in said dimension perpendicular to said direction of propagation;

said phase change applier is operative to apply a plurality of different phase changes to each of said at least one one-dimensional component, thereby obtaining at least one one-dimensional component of said plurality of phase changed transformed wavefronts; and

said intensity map utilizer is operative to obtain an output indicating amplitude and phase of said at least one one-dimensional component of said wavefront being analyzed.

201. Apparatus according to claim 200 and wherein said phase change applier comprises a movement generator, providing a relative movement between said wavefront being analyzed and an element, which element generates spatially varying, time-constant phase changes, said relative movement being in an additional dimension which is perpendicular both to said direction of propagation and to said dimension perpendicular to said direction of propagation.

202. Apparatus according to claim 200 and wherein:

said wavefront being analyzed comprises a plurality of different wavelength components;

said phase change applier is operative to apply a plurality of different phase changes to said plurality of different wavelength components of each of said plurality of one-dimensional components of said wavefront being analyzed; and

said intensity map generator includes a wavelength divider, dividing said plurality of one-dimensional components of said plurality of phase changed transformed wavefronts into separate wavelength components.

203. Apparatus according to claim 202 and wherein:

said wavelength divider includes a dispersion element, dividing said plurality of one-dimensional components of said plurality of phase changed transformed wavefronts passing therethrough into separate wavelength components.

204. Apparatus according to claim 200 and wherein said transform applier includes an additional transform applier, operative to perform an additional Fourier transform to minimize cross-talk between different one-dimensional components of said wavefront being analyzed.

205. Apparatus for surface mapping comprising:

a wavefront obtainer operative to obtain a surface mapping wavefront having an amplitude and a phase, by reflecting radiation from a surface; and

a wavefront analyzer, analyzing said surface mapping wavefront and

comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to said surface mapping wavefront;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indicating said amplitude and phase of said surface mapping wavefront.

206. Apparatus according to claim 205, and wherein said radiation reflected from said surface has a narrow band about a given wavelength, causing said phase of said surface mapping wavefront to be proportional to geometrical variations in said surface, said proportion being an inverse linear function of said wavelength.

207. Apparatus according to claim 205, and wherein said radiation reflected from said surface has at least two narrow bands, each centered about a different wavelength, providing at least two wavelength components in said surface mapping wavefront and at least two indications of said phase of said surface mapping wavefront, thereby enabling an enhanced mapping of said surface to be obtained by avoiding an ambiguity in the mapping which exceeds the larger of said different wavelengths about which said two narrow bands are centered.

208. Apparatus according to claim 205 and wherein said wavefront transformer comprises:

a transform applier, applying a transform to said surface mapping wavefront, thereby to obtain a transformed wavefront; and

a phase change applier, applying a plurality of different phase changes, including spatial phase changes, to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

209. Apparatus according to claim 208, and wherein:

said transform applied to said surface mapping wavefront is a Fourier transform;

said plurality of different phase changes comprises at least three different phase changes, effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

said intensity map utilizer includes:

a wavefront expresser, expressing said surface mapping wavefront as a first complex function which has an amplitude and phase identical to said amplitude and phase of said surface mapping wavefront;

a first intensity map expresser, expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

a complex function definer, defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

a second intensity map expresser, expressing each of said plurality of intensity maps as a third function of:

said amplitude of said surface mapping wavefront;

said absolute value of said second complex function;

a difference between said phase of said surface mapping wavefront and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

a first function solver, solving said third function to obtain said amplitude of said surface mapping wavefront, said absolute value of said second complex function and said difference between said phase of said surface mapping wavefront and said phase of said second complex function;

a second function solver, solving said second complex function to obtain said phase of said second complex function; and

a phase obtainer, obtaining said phase of said surface mapping wavefront by adding said phase of said second complex function to said difference between said phase of said surface mapping wavefront and said phase of said second complex function.

210. Apparatus according to claim 205 and wherein:

said surface mapping wavefront comprises a plurality of different wavelength components; and

said wavefront transformer includes:

a transform applier, applying a transform to said surface mapping wavefront, thereby to obtain a transformed wavefront comprising a plurality of different wavelength components; and

a phase change applier, applying a phase change to said plurality of different wavelength components of said transformed wavefront by passing said transformed wavefront through an object, at least one of whose thickness and refractive index varies spatially.

211. Apparatus for inspecting an object comprising:

a wavefront obtainer operative to obtain an object inspection wavefront which has an amplitude and a phase, by transmitting radiation through said object; and

a wavefront analyzer, analyzing said object inspection wavefront and comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to said object inspection wavefront;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indicating said amplitude and phase of said object inspection wavefront.

212. Apparatus according to claim 211, and wherein when said object is substantially uniform in material and other optical properties, said phase of said object inspection wavefront is proportional to said object thickness.

213. Apparatus according to claim 211, and wherein when said object is substantially uniform in thickness, said phase of said object inspection wavefront is proportional to optical properties of said object.

214. Apparatus according to claim 211, and wherein said radiation has at least two narrow bands, each centered about a different wavelength, providing at least two wavelength components in said object inspection wavefront and at least two indications of said phase of said object inspection wavefront, thereby enabling an enhanced mapping of thickness of said object to be inspected by avoiding an ambiguity in the mapping which exceeds the larger of said different wavelengths about which said two narrow bands are centered.

215. Apparatus according to claim 211, and wherein said wavefront transformer comprises:

a transform applier, applying a transform to said object inspection wavefront, thereby to obtain a transformed wavefront; and

a phase change applier, applying a plurality of different phase changes, including spatial phase changes, to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

216. Apparatus according to claim 215, and wherein:

said transform applied to said object inspection wavefront is a Fourier transform;

said plurality of different phase changes comprises at least three different phase changes, effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

said intensity map utilizer includes:

a wavefront expresser, expressing said object inspection wavefront as a first complex function which has an amplitude and phase identical to said amplitude and phase of said object inspection wavefront;

a first intensity map expresser, expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

a complex function definer, defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

a second intensity map expresser, expressing each of said plurality of intensity maps as a third function of:

said amplitude of said object inspection wavefront;

said absolute value of said second complex function;

a difference between said phase of said object inspection wavefront and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

a first function solver, solving said third function to obtain said amplitude of said object inspection wavefront, said absolute value of said second complex function and said difference between said phase of said object inspection wavefront and said phase of said second complex function;

a second function solver, solving said second complex function to obtain said phase of said second complex function; and

a phase obtainer, obtaining said phase of said object inspection wavefront by adding said phase of said second complex function to said difference between said phase of said object inspection wavefront and said phase of said second complex function.

217. Apparatus according to claim 211 and wherein:

said object inspection wavefront comprises a plurality of different wavelength components; and

said wavefront transformer includes:

a transform applier, applying a transform to said object inspection wavefront thereby obtaining a transformed wavefront comprising a plurality of different wavelength components; and

a phase change applier, applying a phase change to said plurality of different wavelength components of said transformed wavefront by reflecting said transformed wavefront from a spatially varying surface.

218. Apparatus for spectral analysis comprising:

a wavefront obtainer operative to obtain a spectral analysis wavefront having an amplitude and a phase, by causing radiation to impinge on an object;

a wavefront analyzer, analyzing said spectral analysis wavefront and comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to said spectral analysis wavefront which has an amplitude and a phase;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indicating said amplitude and phase of said spectral analysis wavefront; and

a phase and amplitude utilizer, employing said output indicating said amplitude and phase to obtain an output indicating spectral content of said radiation.

219. Apparatus for spectral analysis according to claim 218 and wherein said wavefront obtainer is operative to obtain said spectral analysis wavefront by reflecting said radiation from said object.

220. Apparatus for spectral analysis according to claim 218 and wherein said wavefront obtainer is operative to obtain said spectral analysis wavefront by transmitting said radiation through said object.

221. Apparatus for spectral analysis according to claim 218 and wherein when said radiation is substantially of a single wavelength, said phase of said spectral analysis wavefront is inversely proportional to said single wavelength, and is related to at least one of a surface characteristic and thickness of said impinged object.

222. Apparatus for spectral analysis according to claim 218 and wherein said intensity map utilizer includes:

an intensity map expresser, expressing said plurality of intensity maps as at least one mathematical function of phase and amplitude of said spectral analysis wavefront and of said plurality of different phase changes, wherein at least said phase is unknown and a function generating said plurality of phase changed transformed wavefronts is known; and

a function solver, employing said at least one mathematical function to obtain an output indicating at least said phase.

223. Apparatus according to claim 218 and wherein said wavefront transformer comprises:

a transform applier, applying a transform to said spectral analysis wavefront, thereby to obtain a transformed wavefront; and

a phase change applier, applying a plurality of different phase changes, including spatial phase changes, to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

224. Apparatus according to claim 223, and wherein:

said transform applied to said spectral analysis wavefront is a Fourier transform;

said plurality of different phase changes comprises at least three different phase changes, effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

said intensity map utilizer includes:

a wavefront expresser, expressing said spectral analysis wavefront as a first complex function which has an amplitude and phase identical to said amplitude and phase of said spectral analysis wavefront;

a first intensity map expresser, expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

a complex function definer, defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

a second intensity map expresser, expressing each of said plurality of intensity maps as a third function of:

said amplitude of said spectral analysis wavefront;

said absolute value of said second complex function;

a difference between said phase of said spectral analysis wavefront and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

a first function solver, solving said third function to obtain said amplitude of said spectral analysis wavefront, said absolute value of said second complex function and said difference between said phase of said spectral analysis wavefront and said phase of said second complex function;

a second function solver, solving said second complex function to obtain said phase of said second complex function; and

a phase obtainer, obtaining said phase of said spectral analysis wavefront by adding said phase of said second complex function to said difference between said phase of said spectral analysis wavefront and said phase of said second complex function.

225. Apparatus according to claim 218 and wherein:

said spectral analysis wavefront comprises a plurality of different wavelength components; and

said wavefront transformer is operative to apply a phase change to said plurality of different wavelength components of said spectral analysis wavefront.

226. Apparatus for phase change analysis comprising:

a wavefront obtainer, operative to obtain a phase change analysis wavefront which has an amplitude and a phase;

a transform applier, applying a transform to said phase change analysis wavefront thereby to obtain a transformed wavefront;

a phase change applier, applying a plurality of different phase changes to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indication of differences between said plurality of different phase changes applied to said transformed phase change analysis wavefront.

227. Apparatus according to claim 226, and wherein when lateral shifts appear in said plurality of different phase changes, corresponding changes appear in said plurality of intensity maps, said intensity map utilizer obtains an indication of said lateral shifts.

228. Apparatus according to claim 226, and wherein said intensity map utilizer includes:

an intensity map expresser, expressing said plurality of intensity maps as at least one mathematical function of phase and amplitude of said phase change analysis wavefront and of said plurality of different phase changes, where at least said phase and amplitude are known and said plurality of different phase changes are unknown; and

a function solver, employing said at least one mathematical function to obtain an output indicating said differences between said plurality of different phase changes.

229. Apparatus for phase change analysis comprising:

a wavefront obtainer, operative to obtain a phase change analysis wavefront

which has an amplitude and a phase;

a transform applier, applying a transform to said phase change analysis wavefront thereby to obtain a transformed wavefront;

a phase change applier, applying at least one phase change to said transformed wavefront, thereby to obtain at least one phase changed transformed wavefront.

an intensity map generator operative to obtain at least one intensity map of said at least one phase changed transformed wavefront; and

an intensity map utilizer, employing said at least one intensity map to obtain an output indication of said at least one phase change applied to said transformed phase change analysis wavefront.

230. Apparatus according to claim 229, and wherein said at least one phase change is a phase delay, having a value selected from a plurality of pre-determined values, and said output indication of said at least one phase change includes said value of said phase delay.

231. Apparatus for stored data retrieval comprising:

a wavefront obtainer operative to obtain a stored data retrieval wavefront which has an amplitude and a phase, by reflecting radiation from media in which information is encoded by selecting the height of the media at each of a multiplicity of different locations on the media;

a wavefront analyzer, analyzing said stored data retrieval wavefront and comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to said stored data retrieval wavefront;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an indication of said amplitude and phase of said stored data retrieval wavefront; and

a phase and amplitude utilizer, employing said indication of said amplitude and phase to obtain said information.

232. Apparatus according to claim 231, and wherein said wavefront transformer comprises:

a transform applier, applying a transform to said stored data retrieval wavefront thereby to obtain a transformed wavefront; and

a phase change applier, applying a plurality of different phase changes to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

233. Apparatus according to claim 232, and wherein:

said transform applied to said stored data retrieval wavefront is a Fourier transform;

said plurality of different phase changes comprises at least three different phase changes, effected by applying a spatially uniform, time-varying spatial phase change to part of said transformed wavefront;

said plurality of intensity maps comprises at least three intensity maps; and

said intensity map utilizer includes:

a wavefront expresser, expressing said stored data retrieval wavefront as a first complex function which has an amplitude and phase identical to said amplitude and phase of said stored data retrieval wavefront;

a first intensity map expresser, expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

a complex function definer, defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

a second intensity map expresser expressing each of said plurality of intensity maps as a third function of:

said amplitude of said stored data retrieval wavefront;

said absolute value of said second complex function;

a difference between said phase of said stored data retrieval wavefront and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

a first function solver, solving said third function to obtain said amplitude of said stored data retrieval wavefront, said absolute value of said second complex function and said difference between said phase of said stored data retrieval wavefront and said phase of said second complex function;

a second function solver, solving said second complex function to obtain said phase of said second complex function; and

a phase obtainer, obtaining said phase of said stored data retrieval wavefront by adding said phase of said second complex function to said difference between said phase of said stored data retrieval wavefront and said phase of said second complex function.

234. Apparatus according to claim 232 and wherein:

said stored data retrieval wavefront comprises at least one one-dimensional component;

said transform applier is operative to perform a one-dimensional Fourier transform to said data retrieval wavefront, performed in a dimension perpendicular to a direction of propagation of said data retrieval wavefront, thereby to obtain at least one one-dimensional component of said transformed wavefront in said dimension perpendicular to said direction of propagation;

said phase change applier is operative to apply a plurality of different phase changes to each of said at least one one-dimensional component, thereby obtaining at least one one-dimensional component of said plurality of phase changed transformed wavefronts; and

said intensity map utilizer is operative to obtain an output indicating amplitude and phase of said at least one one-dimensional component of said data retrieval wavefront.

235. Apparatus according to claim 234 and wherein said phase change applier comprises a movement generator, providing a relative movement between said media and a component generating spatially varying, time-constant phase changes, said relative movement being in a dimension perpendicular to said direction of propagation and to said dimension perpendicular to said direction of propagation.

236. Apparatus according to claim 231, and wherein said information is encoded on said media whereby:

an intensity value is realized by reflection of light from each location on said media to lie within a predetermined range of values, said range corresponding an element of said information stored at said location; and

said intensity map utilizer employs said plurality of intensity maps to realize multiple intensity values for each location, providing multiple elements of information for each location on said media.

237. Apparatus according to claim 236 and wherein said plurality of differently phase changed transformed wavefronts comprise a plurality of wavefronts whose phase has been changed by a phase changer, operative to apply an at least time varying phase change function to said stored data retrieval wavefront.

238. Apparatus according to claim 236, and wherein:

said stored data retrieval wavefront comprises a plurality of different wavelength components; and

said wavefront transformer is operative to apply at least one phase change to said plurality of different wavelength components of said stored data retrieval wavefront.

239. Apparatus according to claim 231, and wherein:

said radiation which is reflected from said media comprises a plurality of different wavelength components, resulting in said stored data retrieval wavefront comprising a plurality of different wavelength components; and

said wavefront transformer is operative to apply a phase change to said

plurality of different wavelength components of said stored data retrieval wavefront.

240. Apparatus according to claim 231, and wherein:

said information encoded by selecting the height of the media at each of a multiplicity of different locations on the media is also encoded by selecting the reflectivity of the media at each of a plurality of different locations on the media; and

said phase and amplitude utilizer includes a phase utilizer, employing said indication of said phase to obtain said information encoded by selecting the height of the media and an amplitude utilizer, employing said indication of said amplitude to obtain said information encoded by selecting the reflectivity of the media.

241. Apparatus for 3-dimensional imaging comprising:

a wavefront obtainer operative to obtain a 3-dimensional imaging wavefront, which has an amplitude and a phase, by reflecting radiation from an object to be viewed; and

a wavefront analyzer, analyzing said 3-dimensional imaging wavefront and comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to said 3-dimensional imaging wavefront;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of differently phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indicating said amplitude and phase of said 3-dimensional imaging wavefront.

242. Apparatus according to claim 241, and wherein said radiation reflected from said object has a narrow band about a given wavelength, causing said phase of said 3-dimensional imaging wavefront to be proportional to geometrical variations in said object, said proportion being an inverse linear function of said wavelength.

243. Apparatus according to claim 241 and wherein said wavefront transformer comprises:

a transform applier, applying a transform to said 3-dimensional imaging wavefront, thereby to obtain a transformed wavefront; and

a phase change applier, applying a plurality of different phase changes, including spatial phase changes, to said transformed wavefront, thereby to obtain a plurality of differently phase changed transformed wavefronts.

244. Apparatus according to claim 241 and wherein:

said 3-dimensional imaging wavefront comprises a plurality of different wavelength components; and

said wavefront transformer includes:

a transform applier, applying a transform to said 3-dimensional imaging wavefront, thereby to obtain a transformed wavefront comprising a plurality of different wavelength components; and

a phase change applier, applying phase changes to said plurality of different wavelength components of said transformed wavefront by passing said transformed wavefront through an object, at least one of whose thickness and refractive index varies spatially.

245. Apparatus for wavefront analysis comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to a wavefront being analyzed;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indicating at least phase of said wavefront being analyzed, comprising:

an intensity combiner operative to combine said plurality of intensity maps into a second plurality of combined intensity maps, said second plurality being less than said first plurality;

an indication provider operative to provide at least an output indicative of said phase of said wavefront being analyzed from each of said second plurality of

combined intensity maps; and

an enhanced indication provider, combining said outputs to provide at least an enhanced indication of phase of said wavefront being analyzed.

246. Apparatus for wavefront analysis comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to a wavefront being analyzed;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indicating at least amplitude of said wavefront being analyzed, comprising:

an intensity combiner operative to combine said plurality of intensity maps into a second plurality of combined intensity maps, said second plurality being less than said first plurality;

an indication provider operative to provide at least an output indicative of said amplitude of said wavefront being analyzed from each of said second plurality of combined intensity maps; and

an enhanced indication provider, combining said outputs to provide at least an enhanced indication of amplitude of said wavefront being analyzed.

247. Apparatus for wavefront analysis comprising:

a wavefront transformer operative to provide a plurality of differently phase changed transformed wavefronts corresponding to a wavefront being analyzed;

an intensity map generator operative to provide a plurality of intensity maps of said plurality of phase changed transformed wavefronts; and

an intensity map utilizer, employing said plurality of intensity maps to provide an output indicating at least phase of said wavefront being analyzed, comprising:

an intensity map expresser, expressing said plurality of intensity maps as a function of:

amplitude of said wavefront being analyzed;

phase of said wavefront being analyzed; and

a phase change function characterizing said plurality of differently phase

changed transformed wavefronts;

a complex function definer, defining a complex function of:

said amplitude of said wavefront being analyzed;

said phase of said wavefront being analyzed; and

said phase change function characterizing said plurality of differently phase changed transformed wavefronts,

said complex function being characterized in that intensity at each location in said plurality of intensity maps is a function predominantly of a value of said complex function at said location and of said amplitude and said phase of said wavefront being analyzed at said location;

a complex function expresser, expressing said complex function as a function of said plurality of intensity maps; and

a phase obtainer, obtaining values for said phase by employing said complex function expressed as a function of said plurality of intensity maps.

248. Apparatus for wavefront analysis comprising:

a first transform applier, applying a Fourier transform to a wavefront being analyzed which has an amplitude and a phase thereby to obtain a transformed wavefront;

a phase change applier, applying a spatially uniform time-varying spatial phase change to part of said transformed wavefront, thereby to obtain at least three differently phase changed transformed wavefronts;

a second transform applier, applying a second Fourier transform to said at least three differently phase changed transformed wavefronts, thereby obtaining at least three intensity maps; and

an intensity map utilizer, employing said at least three intensity maps to provide an output indicating at least one of said phase and said amplitude of said wavefront being analyzed and comprising:

a wavefront expresser, expressing said wavefront being analyzed as a first complex function which has an amplitude and phase identical to said amplitude and phase of said wavefront being analyzed;

a first intensity map expresser. expressing said plurality of intensity maps as a function of said first complex function and of a spatial function governing said spatially uniform, time-varying spatial phase change;

a complex function definer, defining a second complex function having an absolute value and a phase as a convolution of said first complex function and of a Fourier transform of said spatial function governing said spatially uniform, time-varying spatial phase change;

a second intensity map expresser, expressing each of said plurality of intensity maps as a third function of:

said amplitude of said wavefront being analyzed;

said absolute value of said second complex function;

a difference between said phase of said wavefront being analyzed and said phase of said second complex function; and

a known phase delay produced by one of said at least three different phase changes, which each correspond to one of said at least three intensity maps;

a first function solver, solving said third function to obtain said amplitude of said wavefront being analyzed, said absolute value of said second complex function and said difference between said phase of said wavefront being analyzed and said phase of said second complex function;

a second function solver, solving said second complex function to obtain said phase of said second complex function; and

a phase obtainer, obtaining said phase of said wavefront being analyzed by adding said phase of said second complex function to said difference between said phase of said wavefront being analyzed and said phase of said second complex function.